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Manufacturing Partnerships: Coordinating Industrial Modernization Services

Phase II Final Report

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Executive Summary

This report presents the findings from the second phase of a project that has tracked efforts to promote service coordination within the U.S. Manufacturing Extension Partnership (MEP). The first phase of the study, which was conducted in 1995-96, examined the initial development, operation, and effects of initiatives to foster local service coordination in the MEP system. The second phase of the study was conducted in 1997-98 and probed subsequent changes in how MEP centers coordinated services with partner organizations, drawing on case studies and other information about partnership activities. The study reviewed best practices for service coordination and developed recommendations for the MEP's federal sponsor, the National Institute of Standards and Technology (NIST).

Best Practices in Service Coordination

During the initial growth of the program, MEP centers established wide-ranging relationships with other local organizations to provide coordinated industrial modernization services to small and medium-sized manufacturing enterprises (SMEs). MEP centers are now rationalizing their relationships with the service partners. The planned reduction in NIST federal funds to MEP centers has triggered this rationalization. There has also been much learning about how to best structure partnerships. Drawing on this learning in case study centers, the study reviewed best practices in service coordination, and examined how these practices are evolving under current conditions:

- **Shared system-wide partnership vision**. Program visions of service partnership have changed from a wide-ranging set of organizations (at the point of greatest federal funds) to fewer, well-defined relationships, along with an increasing number of informal organizational associations.
- **Structured flexibility**. Modified funding formulas requiring joint investment and contractual instruments for tracking performance, modification, and termination of relationships are part of a longer-term approach to evolve partner capabilities and links.
- **Joint marketing**. Early practices focused on ways to leverage resources among organizations to cover the costs of reaching more manufacturers. Current practices (e.g., assessing the cost of leads, outsourcing to telemarketing firms, target marketing, streamlining customer contacts around a single center staff member) reflect a focus on the costs and performance in marketing to SMEs in partnership with outside organizations.
- **Coordinated referrals**. The current emphasis on systems to track and manage referrals and monitor performance on a project-by-project basis has led centers to scrap purchased databases of potential service providers (initially used to foster awareness

of what service providers offer), and move to informal systems and the development of in-house provider databases.

- **Collaborative services**. An early practice - inter-organizational service delivery teams - had offered a wide array of expertise, but centers found them to be costly and time consuming. Current approaches focus on center service and project management (often fee-based), streamlining internal subcontracting procedures, and negotiating reduced rate structures.
- **Development and sharing of common tools**. Centers increasingly partner with third party organizations to win proposals to compensate for some part of the reduction in NIST funding and to cover product development costs.
- **Partner communication and information sharing**. Centers are increasingly fostering grassroots relationships between center regional office managers and major service providers in the region, and between center project managers and third party providers involved in certain project areas.
- **Cross-training**. Whereas early initiatives promoted building awareness of different partner capabilities and skills, current approaches tend to promote training for consistent levels of quality and service delivery by staff from multiple organizations.
- **Designated responsibilities and mechanisms to promote the partnership**. At a strategic level, some centers found designating a person for partnership promotion to be effective, however funding reductions discontinued some of these mechanisms and delegated them to project and field office managers.
- **Partnership performance review**. A recent practice, often prompted by NIST panel reviews, encourages centers to conduct regular comprehensive reviews across the portfolio of service relationships to consider if strategic changes are necessary.

Recommendations for NIST

The report makes a series of recommendations to NIST to promote further development and optimization of service coordination. We continue to draw attention to the fact that service coordination has costs and potential tensions as well as significant advantages. Continued federal attention to promoting service coordination is essential.

- **Strategic investment in industrial modernization partnerships**. NIST should specify in cooperative agreements that a portion of federal MEP funds are to be used by centers to maintain and build effective partnerships with other local service providers. Centers should include strategies, goals, and hard budget lines for partnership activities in strategic and operating plans. In addition, NIST should designate a program to promote partnerships, potentially with seed or matching funds for the development of specific projects (e.g., shared tool development, information systems) to promote partnerships.
- **Robust panel review.** The external review process should reinforce center initiatives to optimize relationships with capable partners. The review should take a long-term view of partnerships, focusing on investments in new linkages as well as ongoing re-

lationships with existing partners. In instances where partner relations are an issue, input from key partner organizations should be incorporated into the review process. Independent external reviews should be included in the process when recommending hard decisions that affect local centers.

- **Fostering a national framework for service linkages.** NIST should continue its initiatives to broker agreements at the national level with other agencies. NIST should also pursue further opportunities with membership and industrial or trade associations, and employ MEP managers to travel and promote working relationships at the state and local levels among different programs.
- **Linkages with SBDCs.** Federal policy should encourage local MEP's and SBDC's to better coordinate, but avoid developing standardized models. SBDCs should not be exempt from requirements applied to all service providers that they offer services that are effective, responsive and of high quality as a precondition for continued MEP affiliation. While we do endorse a more general policy of assigning federal funds to the promotion of partnership linkages, case study findings do not endorse the special "earmarking" of MEP funds to be allocated to SBDC linkages. MEP's centers facing new budget situations or changes in customer requirements need to have the flexibility to strategically adjust their partner arrangements.
- **Evaluation.** NIST should review and upgrade procedures for collecting information about MEP partner relationships. NIST should regularly analyze and report data about partnerships so that the system can track trends in partnership linkages. In addition, NIST could include the use, contribution, and costs of partnerships in ongoing and new center benchmarking efforts. To develop broader assessments of the contribution of MEP partnerships, NIST should involve other MEP partners in structured discussions about how to better measure the value of partnerships to regional industrial communities.
- **Best practice dissemination.** NIST should promote the exchange of information and experience in managing partnerships. Existing program manager guidance, written materials, and program reviews may be supplemented with partnership-focused forums, training events, the exchange of personnel, ongoing benchmarking, and the development and dissemination of case examples of firm assistance involving service coordination. NIST should use the MEP World Wide Web site to disseminate model contract clauses, partnership plans, and other useful partnership practices.

Abbreviations and Acronyms

AMC	Advanced Manufacturing Center
AMLC	Advanced Manufacturing Learning Center (Cleveland State University)
BIRL	Business Industrial Research Laboratory (Northwestern University)
BOS	Business Outreach Services (University of Georgia)
CAD	Computer-aided design
CAEL	Council for Adult and Experiential Learning
CAISR	Center for Automation and Intelligent Systems Research (Cleveland)
CAM	Computer-aided manufacturing
CAMP	Cleveland Advanced Manufacturing Program
CFMTC	Central Florida Manufacturing Technology Center
CHMR	Center for Hazardous Materials Research
CMC	Chicago Manufacturing Center
CMIT	Center for Manufacturing Information Technology (Georgia Tech)
CTC	Concurrent Technologies Corporation
DTAE	Department of Technical and Adult Education (Georgia)
ECRC	Electronic Commerce Resource Center
EDI	Economic Development Institute (Georgia Tech)
ESTC	Edison Sensor Technology Center (Cleveland, Ohio)
EWI	Edison Welding Institute (Columbus, Ohio)
FMEP	Florida Manufacturing Extension Partnership
FMTC	Florida Manufacturing Technology Center
FY	Financial Year
GLMTC	Great Lakes Manufacturing Technology Center (Cleveland, Ohio)
GMEA	Georgia Manufacturing Extension Alliance
ICC	Industry and Commercialization Center (Florida)
IET	Institute for Economic Transformation (Duquesne University)
INC	Industry Network Corporation
IRC	Industrial Resource Center
ISO 9000	International Organization for Standardization—procedures for quality standards
LAN	Local area network
LIRI	Local Industrial Retention Institute (Chicago)
m	million

MEP	Manufacturing Extension Partnership
MEP-SWPA	Manufacturing Extension Partnership of Southwestern Pennsylvania
MTC	Manufacturing Technology Center
NASA	National Aeronautics and Space Administration
NFMTC	North Florida Manufacturing Technology Center
NHA	National Housewares Association
NIST	National Institute of Standards and Technology
NMINC	New Mexico Industry Network Corporation
NMSU	New Mexico State University
NOM-SBDC	North Ohio Manufacturing Small Business Development Center
NTU	National Technological University
NWIRC	Northwestern Pennsylvania Industrial Resource Center
P2AD	Pollution Prevention Assistance Division (Georgia Department of Natural Resources)
PBS	Performance Benchmarking Service
QS 9000	Quality Standard for the automotive industry
RFP	Request for proposal
RMOC	Regional Manufacturing Outreach Center
SBDC	Small Business Development Center
SERA	Southeast Environmental Resource Alliance
SFMTC	South Florida Manufacturing Technology Center
SIGRED	Silver City-Grant County Economic Development Corporation (New Mexico)
SME	Small and medium-sized manufacturing enterprise
SMTC	Suncoast Manufacturing Technology Center (Florida)
SPI	Society of the Plastics Industry
SPIRC	Southwestern Pennsylvania Industrial Resource Center (Pittsburgh)
STAC	Southern Technology Applications Center
TAC	Technology Applications Center (Georgia Power)
TLO	Technology Linkages Office (Georgia Tech)
TRP	Technology Reinvestment Project
UTC	Unified Technologies Center (Cuyahoga Community College, Cleveland)
WINOC	Work in Northeast Ohio Council
WIRE-Net	Westside Industrial Retention and Expansion Network (Cleveland)
WMRC	Waste Management Research Center (Illinois)

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1. Introduction

Partnerships among and between private and public organizations are increasingly important for policy implementation and program provision in the United States (Gore 1993, Osborne and Gaebler 1993, Brody 1996, Shapira, Kingsley and Youtie 1997). In the field of technology policy and technology transfer, there are now numerous cooperative programs involving a wide range of public and private participants. By the mid-1990s, it was reported that ten federal agencies had joined with states, industry and other organizations to spend $3.1 billion a year on hundreds of partnered technology programs (Berglund and Coburn 1995).

The Manufacturing Extension Partnership (MEP) exemplifies this partnership trend. The MEP is a network of technology assistance and business service providers that aims to upgrade the performance and competitiveness of U.S. small and medium-sized manufacturing enterprises (SMEs).[1] The program is a collaborative initiative between federal and state governments which also involves non-profit organizations, academic institutions, and industry groups. The National Institute of Standards and Technology (NIST), within the U.S. Department of Commerce, is the MEP's federal sponsor. From three Manufacturing Technology Centers (MTCs) in 1989, the MEP has now grown to a network of more than 70 centers in all fifty states (National Institute of Standards and Technology 1998a; Shapira 1998). Most of the growth in the program has occurred since 1992, with support initially from Department of Defense funds through the federal Technology Reinvestment Project (Advanced Research Projects Agency 1994) and subsequently from the civilian budget of the Department of Commerce, through NIST. In Fiscal Year 1998, federal funding for the MEP of $113 million was matched by at least a further $100 million – with the match mostly from state funds, but including a growing share of fee revenues from private sector customers.

[1] Small and medium-size manufacturing enterprises (SMEs) are generally defined as those with 500 or fewer employees. There are about 415,000 SMEs in the United States, representing 99 percent of all manufacturing enterprises and almost two-fifths of manufacturing jobs. Evidence about the technology and business challenges facing SMEs can be found in several recent studies, for example: Office of Technology Assessment 1990, National Research Council 1993, and Kane 1998.

MEP centers usually operate either as separate non-profit corporations or as part of other organizations, such as universities, state agencies, technology centers, or economic development groups. The MEP program is decentralized and flexible: each center develops strategies and services appropriate to state and local conditions. The individual centers typically employ industrially experienced field personnel who work directly with firms to identify needs, broker resources, and develop appropriate assistance projects. Other services include information provision, technology demonstration, training, and referrals. At the federal level, NIST not only provides matching funds but also coordinates the system, reviews the quality of member centers, sponsors common services such as staff training, tools, and information exchange, and supports national and cross-cutting initiatives in such areas as supply-chain management, environmentally-conscious manufacturing or workforce training. With the growth of the MEP system, almost 30,000 manufacturing firms are being assisted annually through assessments, technical assistance projects, workshops, and other services. Some two-thirds of assisted companies have fewer than 100 employees.

In addition to deploying in-house resources, the MEP centers work with several thousand affiliated public and private organizations across the U.S. These service partnerships allow MEP centers to offer an array of resources, capabilities, and tools to their SME customers (National Institute of Standards and Technology 1998b). Through coordinated partnerships with other technology and business service providers, the MEP seeks to leverage limited public funds, avoid the duplication of services, tap specialized skills, extend awareness and outreach, and promote flexibility in the delivery of services.

Although organizational partnerships between MEP centers and other organizations are often informal, increasingly the trend is for these relationships to be structured in writing, through memoranda of understanding, performance agreements or binding contracts. Formal agreements are universal where money changes hands. But there is no single system-wide model for the whole system; each center has considerable flexibility within allowable legal, auditing and sponsor criteria. MEP centers may entirely underwrite the cost of activities or specialized services by partners, although this mode of partnership is becoming less prevalent as MEP centers face greater pressure to generate fee revenues. In other cases, MEP centers and partners share costs (at times with in-kind as well as cash contributions) or collectively obtain resources for a special project from NIST, the state or another funder. With the aim of generating revenues, some centers seek management fees from outside service providers who implement referred projects with MEP customers. In other instances, vendors, corporations, or large private consultants may donate cash, equipment, in kind or pro-bono services in liaison with MEP centers.

In 1995, we embarked upon a study to track efforts to promote service coordination within the MEP system. The study has been conducted in two successive phases. In Phase I of the study, we examined the initial development, operation, and effects of efforts to

promote local service coordination in the MEP system.[2] This phase included case studies of six MEP centers (listed in section 2 of the report). From these case studies, we identified a set of best practices for MEP service coordination (summarized in box 1).

As the MEP system has evolved from the stage of rapid growth (1993-95) to a position of optimization after 1996, MEP centers have adjusted the ways in which they coordinate with other service providers.[3] In Phase II of the study, which took place in 1997 and early 1998, we were particularly concerned to probe these changes in how MEP centers coordinated services with partner organizations. We also sought to assess the impacts of service coordination on the delivery of industrial modernization services and to refine our recommendations for best practices in service coordination.

Box 1. Best Practices for Coordination of Industrial Modernization Services – Identified in Phase I of Study

- **Shared system-wide partnership vision** – where MEP centers select certain partners and arrangements sharing a common perspective about program goals and methods.
- **Structured flexibility** – through which MEP centers consciously consider and anticipate the evolution of partner capabilities and relationships.
- **Joint marketing efforts** – such as uniform marketing materials, jointly sponsored seminars and workshops, and co-located offices.
- **Cross-training** – which allows individuals and organizations to learn skills and capabilities from one another.
- **Shared information exchange** – through formal and informal communication methods and relationships.
- **Coordinated service tools** – including the shared development and use of tools to serve customers
- **Coordinated referral systems** – to ensure customers receive appropriate and qualified assistance
- **Collaborative service delivery** – of assessments and projects.
- **Specific partnership promotion mechanisms** – including designated personnel functions or responsibilities to promote, facilitate, and monitor partnership links, contracts, databases, paperwork, and other requirements of partnerships.
- **Partnership performance review** – of individual partner accomplishments and overall partnership portfolio in context of changing industry needs and existing resources

Source: Shapira and Youtie (1996).

[2] See: P. Shapira and J. Youtie, with G. Kingsley and M. Cummings, *Coordinating Industrial Modernization Services: Impacts and Insights from the U.S. Manufacturing Extension Partnership*, Atlanta, Georgia: Georgia Institute of Technology, 1996. This report is available on the worldwide web via the Georgia Tech Policy Project on Industrial Modernization <http://www.cherry.gatech.edu/mod>.

[3] For an overview of recent developments in the MEP system, see Shapira (1998).

This current document is the final report of the Phase II study. After an overview of the study design, we report our updated analysis of the national picture of MEP partnerships and present summaries of the Phase II case studies. We then use this evidence to consider the consequences of efforts to promote partnership and coordination among industrial service providers, including the "additionality" generated by the federal government, through the MEP, in promoting partnerships that otherwise might not have existed. We discuss the costs and drawbacks associated with partnered services as well as the benefits and advantages. The report highlights a set of practices in service partnerships (including a look at how these practices have changed over time), with the aim of offering guidance and probes to program managers as they seek to optimize the gains from partnered service coordination. It concludes with a series of recommendations to guide NIST in its efforts to enhance service partnerships.

2. Phase II: Key Questions and Study Design

In Phase II of the project, three major questions were addressed:

1) **How do MEP partnerships change and evolve over time, and how does this affect the coordination and delivery of MEP services?**
   There are ongoing changes in how MEP centers structure their partnership arrangements. Centers and partners learn more about each others' capabilities, needs and interests over time; relationships are tightened, loosened, or terminated; and new partners or services are added as perceptions of needs change, center strategies are altered, and difference mixes of funding become available. The project aimed to look extensively at how centers modified and adjusted their partner relationships, and examine the reasons for these changes and their impacts. Building on the insights gained from Phase I of the project, this element would allow us to update and verify durable best practices in the operation and management of service partnerships able to guide center and MEP managers.

2) **What practices at the MEP field level are most likely to lead to successful customer services delivered jointly or through partners?**
   At the MEP service delivery level, there are certain "decision rules" and processes that field agents use (both implicitly and explicitly) to select and deliver services to small and medium-sized manufacturers. In Phase II of the project, we were concerned to probe two interrelated issues. First, how field personnel judge that a company or project requires assistance from a third-party service provider; and, second, how field personnel determine which specific services providers should be used for a firm in a particular situation. The intent was to gain detailed insights into the practices (including "rules of thumb") that are used at the field level to deliver MEP services to customers. In turn, this would allow us to understand the combinations of

practices and experiences that not only affect service quality, but also influence how center managers organize their relationships with other service providers.

3) **What roles can NIST play to enhance local MEP partnerships?**
NIST, as the lead federal agency guiding the operation and development of the MEP system, has a critical role in influencing the character, scale, and scope of the service partnerships that local MEP centers enter into. In this element of the project, we aimed to develop recommendations about what NIST could and should do to help local MEP partnerships operate most effectively. One of the "framing" factors to be considered in this element was the anticipated decrease in core MEP federal funding to about one-third of each MEP centers operating costs. If implemented, NIST would shift from being a "majority" to a "minority" stakeholder in the preponderance of MEP centers. We sought to explore how NIST might most usefully target its resources to guide and promote local partnerships given these anticipated changes in funding arrangements.

In collecting information and evidence to pursue the principal questions posed by the study, we undertook an updated national analysis of MEP partnership trends (reported in section 3 of this report) and reviewed available literature and complementary studies. However, to serve as a primary source of data, it was judged that in-field case studies at the center level would be the most appropriate and feasible method. In Phase I of the project, we conducted six in-field case studies. Six further case studies were completed for Phase II of the study (see table 1).

We selected the case study sites aided by information from the national data analysis, our own knowledge of MEP centers and operations, nominations from NIST personnel, discussions with MEP regional managers, and a review (in Phase I) by the project's advisory panel. Criteria for selection included issues of geographic location, historical context, types of services offered, and the "exemplary" features each selected center would add to the study of service coordination.

The design of Phase II involved revisiting four of the original case study centers – the Chicago Manufacturing Center, the Georgia Manufacturing Extension Alliance, the Great Lakes Manufacturing Technology Center (Cleveland, Ohio), and Manufacturing Extension Partnership of Southwest Pennsylvania. About two years had elapsed between the first and second field visits to these centers. Two new centers were added: the Florida Manufacturing Technology Center and the Industry Network Corporation (INC).

At the Phase II case study sites, structured interviews were conducted with MEP program managers, field staff, partner organizations, small business customers, and state program sponsors. Reviews of program documents from each center and its affiliates and an analysis of information from the MEP national reporting system augmented the case studies. In the INC case, the program is a multi-state "franchise" with a service area cov-

Table 1. Service Coordination Study Project: Case Study Sites, Phases I and II

Manufacturing Extension Partnership Center	Service Area	Case Study	
		Phase I	Phase II
Chicago Manufacturing Center (CMC)	Chicago, Illinois, metropolitan area	✓	
Florida Manufacturing Technology Center (FMTC)	State of Florida		✓
Georgia Manufacturing Extension Alliance (GMEA)	State of Georgia	✓	✓
Great Lakes Manufacturing Technology Center (GLMTC)	Cleveland, Ohio, metropolitan area	✓	✓
Industry Network Corporation (INC)	Multi-state service franchise – New Mexico, Arizona, Nevada, Alaska, and Hawaii		✓
Manufacturing Extension Partnership of Southwest Pennsylvania – Southwest Pennsylvania Industrial Resource Center (SPIRC)	Pittsburgh, Pennsylvania, metropolitan area	✓	✓
Minnesota Manufacturing Technology Center (MMTC)	State of Minnesota	✓	✓
Oklahoma Alliance for Manufacturing Excellence	State of Oklahoma	✓	

ering the states of New Mexico, Arizona, Nevada, Alaska, and Hawaii. Resource constraints meant that field interviews were conducted only in INC's headquarters state of New Mexico (with visits made to local service providers in New Mexico).

The Phase II case studies are summarized in section 4, with additional details included in the appendices to the main report. The full case studies are contained in appendix B, with a list of the individuals interviewed provided in appendix C. The interview protocols used for the case studies are included in appendix D.

During the course of the Phase II study, NIST asked that we focus additional attention to the links between the case study centers and Small Business Development Centers (SBDCs). All case study centers had some links with SBDCs. However, two of the centers – the Great Lakes Manufacturing Technology Center and the Georgia Manufacturing Extension Alliance – had specific relationships and programs with SBDCs. Insights from the experiences of these MEP centers in working with SBDCs are included in the respective case studies (see appendix B).

3. Partnered Service Coordination in the MEP: The National Picture

Across the United States, MEP centers have established relationships with many other providers of technology and business services, as well as with organizations that have interests in upgrading SMEs. In mid-1997, more than 2,600 organizations were associated in some way with 68 of the MEP centers reporting this data into NIST's national reporting system.[4] (See Appendix A for more information.) Figure 1 illustrates the extent of this affiliate network, by mapping the location of MEP affiliates relative to the location of MEP offices.

Although there are issues of data comparability, the number of MEP affiliates reported in 1997 is more than three times greater than the 750 affiliated organizations reported by 40 centers at the end of 1995. It suggests that MEP center affiliations with third party service providers have grown.[5] The most common relationships are with economic development organizations and universities. About 95 percent of centers have relationships with these types of organizations (figure 2). The next most common type of organizational relationship, for two-thirds percent of the centers, is with community or vocational colleges and technical institutes. Almost sixty percent of centers have relationships with industry associations and small business development centers, and about one-half with private consulting companies. To a lesser extent, partner relationships are also reported with federal laboratories, larger companies, utilities, and training organizations.

These organizational partnerships take a variety of forms. Many MEP centers have arrangements where other service providers act as program affiliates to perform particular operating functions, such as marketing to prospective customers, or provide specialized services, for example in helping manufacturers with environmental compliance. MEP centers have also established collaborative initiatives with industry associations, large manufacturers, technology centers, and other groups through which information, training, networking, technology diffusion, or other special projects are targeted to SMEs in a particular locality, industry, or supply chain.

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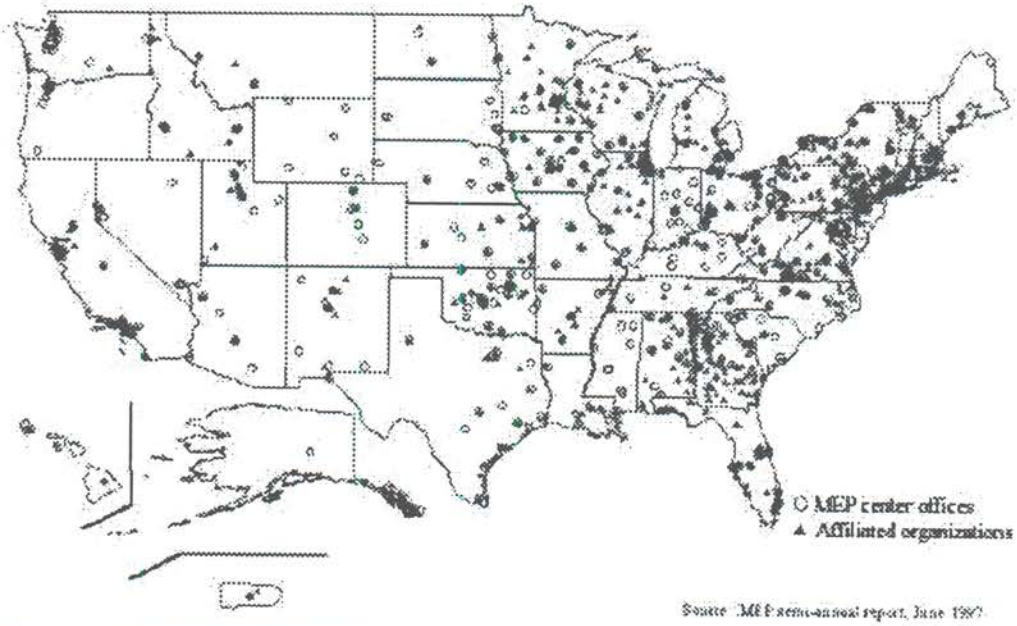
[4] Analysis of MEP center reports to NIST, June 1997, with removal of duplicative information. There are variations in how different centers define and report their affiliates. Some centers do not report information about organizations that staff informally used to provide assistance to manufacturers. In addition, data from seven mostly newer MEP centers is not included in this analysis.

[5] In mid-1997, the average MEP center reported 38 organizational affiliates, compared to 19 such relationships at the end of 1995. One center reported 280 relationships, while five centers reported more than 100 relationships. At the other end of the spectrum, four centers reported only one or two organizational affiliates. To account for this variation, we also note the median number of organizational affiliates in mid-1997 was 26.

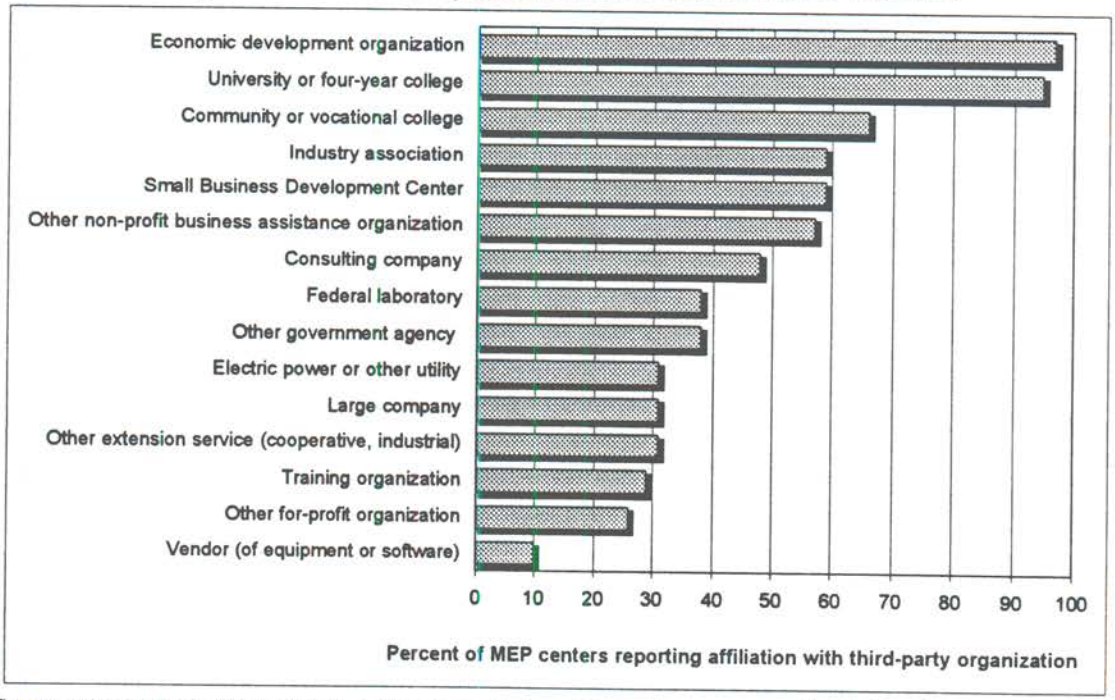
Figure 1

Manufacturing Extension Partnership (MEP) Center Offices and their Affiliated Organizations



Source: MEP semi-annual report, June 1997

Figure 2. Third-Party Service Affiliations of MEP Centers



Source: Analysis of Manufacturing Extension Partnership center reports to the National Institute of Standards and Technology, June 1997. Base number of centers reporting is 68. For New York State, 10 centers reporting results have been treated as one center because they reported in aggregate.

Perhaps most frequently, MEP centers use other service providers on a subcontract or referral basis. About one-quarter of MEP's technical assistance projects involve outside service providers.[6] In such cases, center staff typically conduct an assessment of a customer's needs, propose a project, and then recommend qualified outside service providers or consultants to assist in implementation. Centers tend to use other service providers in fields both outside of and within traditional MEP core competencies. Human resource projects, where most MEP centers do not have in-depth expertise, are most likely to involve outside service providers. However, the second most common area for third party projects – process improvement – is a central MEP core competency. Here, the involvement of outside partners to provide services presumably leverages the number of projects within their field of expertise that center staff can manage. Other common areas for third party projects include business systems and management, market development, and quality. In addition, projects involving third party providers, compared to projects delivered by in-house staff, tend to be longer, both in elapsed time and in hours of effort required to complete the project. Projects involving third party providers are more likely to represent follow-on work with existing customers rather than to be the first project with a customer. They also tend to be delivered through one-on-one assistance rather than to groups of manufacturers. (See Appendix A for more information.)

4. The Cases

This section of the report *summarizes* the service coordination case studies of six centers conducted for Phase II of the project. The cases were conducted in the fall of 1997. (Appendix B presents *full* case study write-ups.)

- **Chicago Manufacturing Center**

Established in 1994, the Chicago Manufacturing Center (CMC) is in its fourth year of operation within the National Institute of Standards and Technology's (NIST) Manufacturing Extension Partnership (MEP). CMC covers the six-county metropolitan Chicago area and its 16,000 small and mid-size manufacturers. Several key elements of CMC's operation have changed in Year 4. Although NIST MEP's grant to CMC has declined to $2.8 million, an additional $0.3 million in corporate sponsor and client fee revenue is estimated. In addition, CMC has sought out and has been awarded grants from state and federal sources that offset the reduction in the federal share of CMC's operating budget. These grants support CMC's new program initiatives including the environmentally-sound manufacturing integration program and international business development program. CMC also has a new center director, expanded advisory board, and 12 new perma-

[6] Analysis of 8,443 technical assistance projects of 8 hours or more with companies completed by 59 MEP centers in 1996 shows that outside service providers were involved in 24 percent of projects.

nent employees. Other new initiatives include: the hiring of a private sector telemarketing firm to set up initial customer visits; the abandonment of the center's central subcontractor referral database (provided by an outside firm) and plans to build a new central database which contains more relevant information about subcontractors, and the continued use of CMC affiliates and third party providers to implementing projects, with the split in fee revenues retained by CMC increasing.

CMC's relationships with outside organizations have changed considerably over the past two years. CMC maintains about 20 contract-based inter-organizational relationships. CMC did not renew contracts with Chicago's Local Industrial Retention Institutes (LIRIs). The Council for Adult and Experiential Learning (CAEL) and Argonne National Laboratory have gone from being major program affiliates which receive CMC funds to being subcontractors that can be called in to work on particular projects. The formal relationship between CMC and Northwestern University has ended because of the dissolution of the university's Business Industrial Research Laboratory. Several new partnership initiatives have taken the place of these relationships. CMC established affiliate relationships with eight suburban community colleges and one economic development commission to reach manufacturers in the outlying suburbs. CMC is working toward establishing relationships with trade associations such as the National Housewares Association, American Electronics Association, and Society of Plastics Industry. CMC heads several environmental grants aimed at facilitating interrelationships among the state's provide and public service providers. CMC continues its relationship with Shorebank Enterprises in the Austin neighborhood.

- **Florida Manufacturing Technology Center**

Florida Manufacturing Technology Center (FMTC) is a major component of a statewide non-profit economic development entity known as Enterprise Florida. In 1996, Enterprise Florida was designated as the state's lead economic development organization, taking over key functions of the former Florida Department of Commerce. As part of a prior state program in the early to mid 1990s, four freestanding regional manufacturing technology centers were established with separate structures and approaches to services under the shared sponsorship of FMTC. The emergence of Enterprise Florida and the association of the state system with the national MEP have substantively changed the framework within which each of the four manufacturing technology centers operates. Nonetheless, at the time of our case study visit, each FMTC center was pursuing its own stance towards service partnering and associated issues of marketing, contracting and outsourcing of service delivery. One center actively seeks service partnerships, including informal partnerships where no money changes hands. Another center prefers to do most of its work in-house and, when partners are used for service delivery, uses them selectively as subcontracts to deliver services for fees. Significantly, the centers in the FMTC system do not offer general or ongoing funding to service partners and affiliates.

Alliances and partnerships exist both at the statewide level, and at the level of the four component regional centers. Varied organizations are involved through these links, including economic development groups, manufacturers' associations, community colleges, universities, utilities, and national laboratories. Statewide linkages already exist with NASA, federal labs such as Sandia and Oak Ridge, and the Southeast Trade Adjustment Center at Georgia Institute of Technology in Atlanta. FMTC management considers that service partnerships are likely to expand in the future, particularly if federal or state funds for manufacturing extension decline. Currently, FMTC averages a cost recovery rate of 32 percent (with significant variation in cost recovery among the four component centers). FMTC is still at an early stage in its development. It is expected that greater use of partnerships will be made in the future.

- **Georgia Manufacturing Extension Alliance**

The Georgia Manufacturing Extension Alliance (GMEA) provides industrial extension and technology deployment services to the state's 10,000+ small and mid-sized manufacturers.[7] The lead organization is Georgia Tech, which has a 35-year history of providing industrial extension services, was established as an MEP center in 1994. Through its budget of more than $7.5 million, GMEA operates a decentralized network of 18 regional offices throughout the state, specialized skill centers, and a staff of 55 full-time equivalent employees. GMEA was initially formed as a partnership among four organizations: Georgia Tech, an electric utility company, the state SBDC program, and the technical institute system's QuickStart training program. Traditionally, the state had funded separate systems for industrial extension, business development, and industrial training, without explicit efforts at coordination.

In the past year, GMEA has re-organized services into eight defined product areas. The center reports more than 160 third party affiliations, some of which are center-wide and others of which are associated with specific regional offices. GMEA's regional offices are co-located with eight SBDC offices and four state economic development representatives. GMEA does most of its project work in-house, with about one-third of the projects involve some type of referral. Third party organizations tend to be used in a referral mode (i.e., without the oversight of a GMEA project manager), in part because referrals do not require processing subcontracts through the sometimes unwieldy Georgia Tech system.

In the initial years of GMEA, funds were allocated to the state SBDC program (matched by SBDC resources) to strengthen linkages between the state's industrial extension and business development systems. An SBDC counselor was attached to GMEA, an assessment tool with a financial component was developed, and GMEA and SBDC co-located offices at sites around the state. Effective working linkages were formed between the two programs. However, with the reduction of federal funding that occurred in GMEA's

[7] In 1998, GMEA was renamed as the Georgia Manufacturing Extension Alliance (GaMEP).

fourth year, the subcontract with the state SBDC program ended, although relationships remain good, the co-located offices remain, and local collaborative links continue.

At the same time, GMEA funding to QuickStart has also ended, while the electric utility has restructured in response to deregulation and is eliminating its in-kind contribution. GMEA used its initial NIST funds to support a manager responsible for facilitating relationships with federal laboratories and Georgia Tech faculty members and researchers, and a staff specialist to coordinate evaluation information. These positions have been eliminated in response to the ramp down of NIST funding. GMEA received grants that paid Georgia Tech's field engineers to market the services and capabilities of the Edison Welding Institute and certain NASA units. Although these grants generated leads, in the case of the Edison Welding Institute, once the grant ended, the relationship became less active. GMEA continues to have good relationships with state economic development organizations, participating in a grant-based environmental consortium, and, in a limited technically-oriented role, in a federal-state international trade center partnership. In general, reduction in federal funds has led to a reduction in the formal role of third party providers, although an extensive base of informal partnership links continues.

- **Great Lakes Manufacturing Technology Center**

The Great Lakes Manufacturing Technology Center (GLMTC) is one of the first three centers in the NIST Manufacturing Extension Partnership, established in 1989 through its host organization the Cleveland Advanced Manufacturing Program (CAMP). GLMTC currently serves 11,000 manufacturers in metropolitan Cleveland and, through its Regional Manufacturing Outreach Center, eastern Ohio. GLMTC had established relationships with service partners in the early 1990s, but these linkages were extended under MEP funding. With a 1998 budget of nearly $9 million, GLMTC employs a core full-time equivalent staff of 43 and the center is linked to an extensive network of more than 80 external organizations. Use of third party providers accounts for more than 63 percent of the projects and roughly 50 percent of project revenue. As a result of a recent CAMP/GLMTC restructuring, GLMTC, in most cases, designates an account manager as the single point of contact for manufacturing customer. GLMTC also provides project management functions, business cards for third party organizations, and training in GLMTC service delivery approaches, although clients generally know that they are working with a third party organization.

In 1994, GLMTC received additional NIST funds in a pilot project to establish tighter linkages with small business development centers (SBDCs). A manufacturing-focused SBDC was created. GLMTC found that manufacturers did not need traditional SBDC business services, so the funds were used to develop manufacturing-focused marketing, planning, and financial expertise, using personnel with industry experience. A Northen Ohio Manufacturing SBDC was created (NOM-SBDC). When the three-year pilot proj-

ect ended, GLMTC transferred this expertise in-house, without an association with the SBDC name. However, grassroots links with local SBDC centers have been maintained.

GLMTC has also restructured other partner relationships. More work is being done with Cleveland State University's Advanced Manufacturing Learning Center, the Cleveland Council for Adult and Experiential Learning, the Cleveland Electronic Commerce Resource Center, and two large private sector engineering consulting firms. There are less active relationships with the major community college in Cleveland, neighborhood economic development organization, and several technical and community colleges in eastern Ohio. Lack of manufacturing capabilities an emphasis on working with manufacturers interested in and able to afford GLMTC's services contributed to these changing relationships. These restructurings prompted GLMTC to streamline internal procedures and modify/terminate contractual relationships to facilitate changes in organizational relationships. New partnership initiatives in environmental, workforce development, and business service areas have been added in response to NIST program development initiatives.

- **Industry Network Corporation**

INC became a MEP center in 1994 serving the state of New Mexico and the El Paso region of western Texas. Since that time additional cooperative agreements have been signed for INC to manage MEP centers in Arizona, Alaska, Hawaii, and Nevada. This expansion has been sought by INC as part of a corporate strategy for developing a regional service base rather than being focused on one particular state. INC officials estimate that this service region currently has 10,000 manufacturers. At present, INC receives roughly $8.3 million, and retained earnings have increased to $1 million. State monies come either in the form of program and project funding from the state government or through the contributions of partners to the performance of projects rather than as direct allocations to INC.

This has spurred INC towards adopting a low fixed cost/high variable cost virtual model of operations. INC seeks to do everything on a contractual basis including all relationships with consulting engineers, customers, and private sector suppliers. For each state INC has only one employee, a regional manager, whose responsibility is to supervise the project engineers working on contracts, make sure that the relationship with INC partners is good, and facilitate communication between customers, partners and project engineers. Project engineers are co-located with partner organizations and treated as members of the staff of their host organization. Over 90% of INC business comes from referrals made by partner organizations. INC project managers conduct assessments, then generally recommend outside contractors selected from INC's system-wide electronic provider database.

INC's approach to partnerships across its multi-state service franchise varies by state. Arizona INC has established partnerships with strong industry associations and not-for-

profit economic development programs that are anchored in cooperative efforts led by the private sector. In contrast, other states in which INC has operations have forged partnerships with public sector organizations. A goal of INC is to earn a minimum of 50% of revenues through client fees. With the encouragement of NIST, INC is moving towards evaluating each partner according to a new gross margin goal. Partner performance will be assessed by aggregating the productivity of engineers working with each partner. This will then matched with the aggregate costs of the partnership.

- **Manufacturing Extension Partnership of Southwest Pennsylvania – Southwest Pennsylvania Industrial Resource Corporation**

The Manufacturing Extension Partnership of Southwest Pennsylvania (MEP-SWPA) became part of the MEP program in March 1994. The partnership's lead organization, the Southwestern Pennsylvania Industrial Resource Center (SPIRC), was established as one of eight Industrial Resource Centers (IRC) by the state of Pennsylvania in 1988. The program's service area includes some 4,000 small and mid-size manufacturing enterprises in metropolitan Pittsburgh and adjacent counties in southwestern Pennsylvania. The current budget is $4.8 million supporting 28 full time equivalent employees. Twenty percent of this budget goes to SWPA affiliates.

The major change in the MEP-SWPA affiliations has been a reduction in the number of affiliated organizations from 16 to three. In its first three years, MEP-SWPA was a partnership of 16 organizations and SPIRC, reflecting a compromise that merged proposals by two different groups of service providers. At its third year review, SPIRC was asked by NIST to perform a partner performance review to reduce the number of partners to a more manageable number. The process involved assessing affiliate relationships based on several factors: whether the relationship added value, e.g. complemented SPIRC's service offerings, enhanced its fee income; the performance of the organizations in delivering quality services; and the importance of the NIST MEP funding to the organization and its relationship with SPIRC.

About 40 percent of the projects in the first half of 1997 were done by third party providers. SPIRC typically charges a 10 percent management fee, which covers contracting, preparation of client reports, and access to the program's information system. This information system also provides access to a statewide provider database; however, concerns about the usefulness of this database have led the SPIRC to plan development of a customized provider database. SPIRC provides marketing and outreach for its affiliates based on a new model consisting of business development managers, a telemarketing function, a new sales approach, and target marketing to certain manufacturing segments. In addition, the program's former multi-organizational direct mail piece is being reconfigured to reflect the new affiliate structure. SPIRC manages major partnership initiatives in the training and workforce development areas, including development of a web site called the Manufacturing Training Network that integrates management, technical, and

workforce training programs for small and mid-sized manufacturers provided by more than 50 third party organizations in southwestern Pennsylvania.

5. Best Practices in Service Coordination

As the case studies illustrate, the MEP system is maturing. From the initial stage of rapid start-up, through which service partnerships helped to quickly establish a nationwide system, the MEP is shifting to program optimization, where service partnerships will be judged by how they contribute to system performance and impact. We have used the insights and experiences gleaned through field interviews with centers, service partners, and customers to identify a set of best practices in service coordination. From these cases, it is evident that service partnerships evolve through successive stages, during which not only is there change in the balance of partnership benefits and costs but also much learning about the how partnerships can be most effectively structured and managed to accommodate changes in customer needs, manufacturing technologies, and state and federal policies. Consequently, although the dimensions of service coordination we identified in Phase I of this study are still applicable, the actual practices of centers within these dimensions have changed over time.

The discussion and practices presented in this section aim to offer guidance to MEP centers as they consider the management of their service relationships and how these relationships can best contribute to center's overall effectiveness. (See also Mitchell 1997 and Westra 1997 for sets of related service coordination practices.) Differences in local industrial and geographical circumstances, institutional histories and capabilities, funding arrangements, and modernization strategies affect particular details in how these practices have been, and can be, applied. Nonetheless, we suggest that these practices have broad applicability across a variety of organizational conditions (including at least some applicability to partnership arrangements in other programs besides the MEP). These practices, organized into 10 dimensions, are described in the following section. Table 3 compares these practices to those identified in the 1995 study.

- **Shared System-wide Partnership Vision**

Partnerships are a means to an end rather than the end itself. Partnerships are thus best constructed in the context of a clear definition of strategic goals; within this, centers should select partners and arrangements that contribute to and, at least in broad terms, share the program's vision about its aims and mission. Different program visions may lead to different partnership coordination styles. In some cases, partnership arrangements involve other organizations in core program management and delivery roles. In other situations, partnership arrangements can be structured to fill relatively narrow roles such as providing key services or access to certain segments of new customers.

Table 3. Summary of Early and Current Practices in Industrial Modernization Service Coordination

Dimension	Early Practices	Current Practices
Joint mission	• Wide ranging partnerships among organizations with broadly similar missions	• Tighter relations/more explicit roles with a few partners • More informal relationships
Structured flexibility	• General plans • Activities to promote awareness, understanding • Meetings, cross-training • Center entirely underwrites partner service costs	• Specific contractual instruments, with clauses for modification, termination • Modified funding formulas requiring joint investment
Joint marketing	• Multi-organization, uniform marketing materials • Jointly-sponsored seminars, workshops • Co-located offices • Pay for leads	• Single customer contact (seamless) • Diverse/targeted marketing materials • Marketing targeted to paying customers, project work • Managed co-locations
Cross-training	• Training to promote awareness of different partner capabilities	• Training in center's service delivery approach, processes
Partner communication, information sharing	• Regular center-wide partnership meetings • Shared electronic information systems	• Decentralized (regional office, project area) partner meetings • Shared electronic information systems with expanded capabilities • Attention to multi-sponsor evaluation requirements
Coordinated referral services	• Identification/awareness of provider, consultant services • Acquisition of electronic provider database	• Evaluation of provider performance • Identification via telephone, e-mail co-locations • Customized in-house database
Collaborative service delivery	• Inter-organizational team assessments and projects	• Service/project management • Streamlined procedures • Negotiated rate structures
Joint development of tools	• Multi-center collaboration	• MEP-third party collaboration for program, service development
Mechanisms to promote partnership	• Center-level	• Project-level (Decentralized responsibility for promoting partnership (project managers/regions) • Use of outside facilitators for provider networks
Partnership performance review	• Individual partner performance reviews	• Comprehensive reviews across the portfolio of service relationships

Source: Case studies.

Early program visions of service partnerships included a wide-ranging set of organizations with varying degrees of relationship to the MEP mission. These visions reflect the point of greatest federal and matching funds, as well as federal requirements to demonstrate a high level of coordination and service partnership. Currently, MEP centers have changed their formal partner arrangements. There are often fewer partners with more defined roles and tighter, contractually-based relationships. Yet paradoxically, as centers are becoming more familiar with other service providers in their region they are adding an increasing number of affiliations with third party organizations on an informal basis.

- **Structured Flexibility**

Partnerships need to combine "structure" – crucial to defining relationships and effective operating frameworks – with "flexibility" to evolve those relationships over time to meet changing conditions and reflect learning about capabilities and limitations. Linkages between MEP centers and other service providers change as centers increase, reduce, or modify their relationships in response to new conditions or judgements about partner performance. Funding formulas in which centers offered outright grant awards to support partner activities in the early years of the relationship may be altered to require parties to invest cash and/or in-kind resources and share costs. Contractual instruments should reflect this, specifying not only objectives but also terms through which performance can be tracked and relationships modified or terminated.

Yet, even though partnerships inevitably grow and change over time, external events or short-term factors should not solely dictate this process. The most effective relationships take time and resources to develop. Mutual trust and a realistic appreciation of strengths, weaknesses, and opportunities have to be established. Methods have to be devised to open up critical resources even if contained in institutions with known problems. Some, although not all, of the case study centers were pursuing this longer-term approach. Best practice thus involves the conscious consideration and anticipation of how partner capabilities and links can evolve. Strategies, plans, and organizational mechanisms should address partnership development over time.

- **Joint Marketing**

The coordination of such outreach mechanisms is an efficient use of resources, particularly given the high cost of marketing to large numbers of dispersed SME. It can also make it easier for SMEs to understand what services are available and present a more consistent customer image. Early practices – joint marketing materials, joint seminars and workshops, co-locations – focused on ways to leverage resources among organizations to cover the costs of reaching a large number of manufacturing customers. Co-locations share the cost of placing center staff throughout the state or region, makes it easier for SMEs to access several services in one location, and facilitates subsequent project collaboration and cross-organization referrals.

Joint marketing practices have changed in recent years, reflecting center focus on the costs and performance in partnering with outside organizations to market to SMEs. There is more emphasis on the quality of lead the partner brings in and the cost to bring it in, as centers set goals to generate an increasing amount of fee revenue from project work. In some cases, centers have outsourced the initial customer screening function to telemarketing firms, so that potential manufacturing customers can be qualified prior to sending field engineers out on costly on-site initial visits. Some centers are targeting certain types of customers and services to meet revenue generation goals. In addition, there is a move toward streamlining customer contacts around a single center staff member, which improves the efficiency of establishing customer relations, reduces duplication, and improves coordination among third party organizations.

- **Coordinated Referral Procedures**

After an initial assessment, MEP customers are frequently referred to other service providers for specific project assistance. To ensure quality, centers and their partnered service providers need to develop effective procedures for qualifying customer needs and making appropriate referrals to one another and to other outside service providers. This requires an awareness of what specific services other providers and consultants offer. In early years, many centers obtained this awareness through purchasing (or having the state or other provider supply) an electronic database of third party organizations. In recent years, there is more emphasis on the need for systems to track and manage referrals and to monitor actual performance on a project-by-project basis. This has led centers to scrap these system-wide databases, many of which lack performance information about provider performance, and move to informal systems (telephone calls, e-mail, electronic postings of questions), and the development of in-house provider databases with more specific information about provider qualifications and capabilities.

- **Collaborative Service Delivery**

Partnered organizations should take advantage of opportunities to collaborate in service delivery to SMEs. This goes beyond referrals, to the development of projects and services that are jointly designed and offered by multi-organizational teams. Examples include structured assessments, where staff with different skills from more than one organization work together in diagnosing company needs, offer recommendations, and implement projects. Inter-organizational team assessments and projects can offer a wider array of expertise to industrial customers, but centers found that these can be time-consuming and relatively costly to implement.

Current approaches to collaborative service delivery focus more on service and project management, streamlining internal subcontracting procedures, and negotiating reduced rate structures which take into account the fact that the center bears the marketing costs

and that center referrals often generate opportunities for follow-on work. For these management services, some centers seek management fees from outside service providers who implement referred projects with MEP customers. Management fees generate revenue, although these fees (generally at around 10 percent of the total project fee) are not substantial relative to the costs involved. At best, the brokering of projects can be a useful source of additional income for centers, but not a major one.

- **Development and Sharing of Common Tools**

Federal funding has encouraged several MEP centers to collaborate with one another and with service partners to develop common tools, such as assessment protocols, benchmarking instruments, or database systems. The sharing of tools saves development costs, allows smaller service providers access to tools they would not otherwise have, and can lead to more consistent operating methods. As the case studies highlighted, centers are increasingly partnering with third party organizations to win proposals for a special project from NIST, the state or another funder. Centers often use this approach to compensate for some part of the reduction in NIST funding and to cover product development costs.

- **Partner Communication and Information Sharing**

Regular communication and information sharing among partners is an essential practice. Such communication is important for establishing strong personal working relationships among individuals in different organizations who perform similar or complementary tasks. Centers adopted many methods in their early years of operation, ranging from regular partnership meetings and newsletters to system-wide electronic information systems. In recent years, there is more emphasis on partner communication below the level of the center director. Centers are fostering grassroots relationships between center regional office managers and major service providers in the region, and between center project managers and third party providers involved in particular project areas.

With improved communication, MEP centers and other public and private organizations are learning about each others needs and information requirements. One are where this learning is apparent is in the area of evaluation. Concerns about different sponsor information reporting and evaluation requirements, as well as issues such as how to assign projects to avoid double-counting customers, are surfacing in center-partner planning and communications.

- **Cross-training**

This allows organizations to learn skills and capabilities from one another. It also can impart the lead center's approach and processes for delivering services across a partnership so that manufacturers receive consistent services regardless of the organization managing the project. Early cross-training initiatives included running internal seminars and

workshops to promote awareness of different partner capabilities and skills. Current training approaches tend to be more specific and focus on a particular set of skills, technologies, or procedures to promote consistent levels of quality and delivery by staff from multiple-organizations.

- **Designated Responsibilities and Mechanisms to Promote the Partnership**

For all partnerships, but especially those that involve multiple or large organizations, it is a best practice to designate responsibilities and establish specific mechanisms to promote the partnership. At an administrative level, effective methods have to be found to contract with partners and to manage funds, with an eye to minimizing paperwork, contracting delays, and other barriers as well as tracking partner performance. At a strategic level, responsibilities for partnership promotion need to be designated, so that opportunities for linking customer needs with special skills or facilities in other organizations are systematically exploited. While some centers found that designating a person for partnership promotion created more active and effective partnerships, they also found this approach to be expensive. With funding reductions, some of these partnership promotion mechanisms have gone away and centers have delegated this function to project and field office managers.

- **Partnership Performance Review**

For service partnerships to be structured towards meeting overall strategic goals and specific performance objectives, methods need to be instituted for partnership assessment. Reviews of partnerships need to occur at the level of individual service providers, which may then lead to specific changes in individual service relationships and contracts. In addition, recent practice, often prompted by NIST panel reviews, encourages centers (and program sponsors) to conduct regular comprehensive reviews across the complete portfolio of service relationships, to consider if strategic changes are necessary in the management, orientation, and composition of partners.

6. MEP Partnerships and Improvements in Industrial Modernization Services: Benefits, Costs and Learning

The national analysis of MEP affiliate linkages and the evidence from the case studies indicate that an extensive – and unprecedented – array of linkages and partnerships between diverse service providers has emerged within the manufacturing extension system in the United States. This networking of service providers is a hallmark characteristic of the U.S. approach to supporting the industrial modernization of SMEs, although efforts to

promote inter-organizational collaboration in delivering industrial services have also emerged in other advanced industrial economies (Bellini 1998).

Many advantages are claimed from promoting partnerships and service coordination in the industrial modernization field. These include reduced duplication, access to special skills, greater flexibility, and the leveraging of scarce public (and private) dollars. Moreover, from the perspective of small and medium-sized customer firms, it is preferable to deal with one organization that can seamlessly and objectively offer a range of needed business services from public and private sources (as opposed to numerous single-function government programs or private vendors promoting only their own products).

To what extent are these professed benefits to service providers, firms, and the overall quality and efficiency of publicly sponsored industrial modernization initiatives actually realized? Our case studies and interviews do confirm that there are real net benefits to service quality and delivery through coordinating networks of local industrial service providers. Enhanced service coordination has made available a wider range of expertise to firms and, in many instances, a more systematic approach to providing assistance. Involving other partners has allowed MEP centers to maintain flexibility and particularly helped the newly established centers to "ramp-up" their services quickly by "leveraging" existing resources. MEP centers have been able to draw upon other well-established organizations, such as economic development organizations, to conduct marketing and outreach campaigns. Facilities at community colleges have been used for business training programs and for demonstrating new technologies. Experts at universities and federal labs have been involved in helping firms to resolve specific technical problems. New working relationships have been forged with private consultants through whom MEP centers have been able to broker a range of business-oriented services to SMEs. Centers have also used partnerships to develop new service offerings. In affiliation with third party organizations, MEP centers have won grants to develop new tools, training, and group service programs and to extend services in critical fields, including environmentally conscious manufacturing and human resources.

In these and other ways, the emphasis on partnership has improved the scale, scope, quality, and efficiency of the services delivered to SMEs through the MEP system. Yet, paradoxically, while the differential characteristics of program partners added new capabilities to the system, efforts to promote tighter service coordination also revealed partner limitations. These affected how various partners performed in delivering extension services to manufacturers. For example, economic development organizations offered general referral services but typically could not provide technological or longer-term project assistance to firms. Work with federal laboratories and university researchers involved particular technical capabilities in narrow fields, but had the potential to be hampered by asynchronous time horizons and administrative barriers within these large institutions. Small business development centers provided needed business planning capabilities, but

their lack of manufacturing background sometimes posed problems in face-to-face dealings with manufacturers (see also the evaluation of MEP-SBDC partnerships in Yin, et. al., 1998). Private-sector consultants had an orientation towards manufacturing needs, but their expense rates and operational styles were often geared to large-manufacturer budgets. The involvement of community colleges promised additional institutional resources for local manufacturing extension partnerships, but these sometimes proved ephemeral as college administrators (under continual funding pressure) focused on their own priorities, rather than the MEP's.

Moreover, although MEP centers have formed partnerships and, in so doing, have met the claim of leveraging resources, it is also apparent that this process has both direct (i.e., MEP) and indirect (i.e., non-MEP) costs. For example, MEP programs actively engaged in service coordination incurred significant transaction costs, including the expense of identifying and qualifying outside providers, information exchange, contracting, consulting, monitoring, and facilitating. Also, in most instances, the other program resources "leveraged" by MEP centers were not "free" in that they had to be paid for by other public or private sources. Additionally, the inter-organizational tensions associated with partnership promotion efforts has required the expenditure of "political" capital, for example in resolving concerns about clients being "stolen" or about one program working in another's territory. (See also Kane, 1997 for examination of potential barriers to service-delivery partnerships with specialty centers.)

The story about service coordination and partnership is thus somewhat more complex than often assumed. Complications and extra costs are involved. But, we emphasize, there are real benefits and, at every center we examined, these benefits significantly exceeded the costs. MEP partnerships have allowed specialized skills and capabilities to be engaged to better meet customer needs, the system is more flexible and responsive through relying on a distributed network of resources rather than building up in-house staff capabilities in all fields, and duplicative service overlaps have been reduced. Overall, we judge that the partnership promotion effort has led to improvements from the perspective of the efficiency and quality of services delivered for the total resources invested. But, and it is more than a footnote, the investments of money, management time, and human energy that are required to build effective partnerships in complex industrial, institutional and political environments should not be overlooked.

Furthermore, it is also evident that service partnerships go through successive stages, during which not only is there change in the balance of benefits and costs but also much learning about the how partnerships can be most effectively structured and managed to accommodate developments in customer needs, technology, and policy. MEP partnerships were first formed under conditions of increased federal and matching funds, with guidance to demonstrate a high level of coordination and service partnership. Under these conditions, MEP centers entered into a wide-ranging set of service partnerships, as our analysis of MEP-affiliated organizations illustrated. However, as MEP centers sub-

sequently operationalized their partnerships, they have better understood the strengths and weaknesses of particular affiliates. This has led to changes in arrangements. In many cases, relationships have been scaled-down or ended. In other situations, links have continued but important adjustments have been made. To take one example, to address the high cost of some private consultants, one center has negotiated reduced rate structures which take into account the fact that the center bears the marketing costs and that center referrals often generate opportunities for follow-on work.

As they have gained more experience with partners and partnerships, we now see many MEP centers undertaking a substantial restructuring of their service coordination arrangements. The outcome has been to focus on tighter links with a smaller set of the most capable partners, with the ability to adjust partner arrangements as customer business and technological needs change. Links with more marginal partners are being reduced, usually – although not always – in an amicable manner that maintains communication and allows collaboration on an as-needed basis. This trend has been accelerated by the reduction in the federal contribution to MEP center costs – from about one-half of each center's budget in the program's early years to a planned steady-state level of one-third. As federal resources become tighter, centers have to reduce their own costs as well as generate additional revenues from customers and other sponsors. Partnerships with other service providers continue to be important. But centers have recognized that they must more exactly specify what each service provider is expected to contribute to the partnership, how partnership performance will be monitored, and under what conditions partnerships will be renewed or, if necessary, terminated.

7. The Federal Role in Industrial Modernization Partnerships and Service Coordination

The Federal Stimulus to Partnership

The federal Technology Reinvestment Project (TRP), which provided the major boost for the growth of the MEP between 1993 and 1995, guided applicants to form partnerships of service providers. There was an explicit requirement that proposals for funding address a criterion entitled, "Coordination and Elimination of Duplication". This criterion required the proposer to understand and link with related service providers in the service region, be consistent with existing state strategies, and not duplicate existing resources or services. Proposers' partnerships were judged in terms of the number, diversity, and skills of constituent service providers, geographic scope and coverage, cohesiveness, organization, and management structure (National Institute of Standards and Technology 1994). Subsequently, MEP management at NIST has continued to emphasize the importance of local MEP partnerships through its operating and management guidelines, the review of center strategic and operating plans, performance evaluations for continued funding, and day-to-day management interactions.

These guidelines have had a fundamental impact in establishing the partnership and service coordination arrangements now evident among industrial modernization service providers in the United States. Our judgement is that today's extensive partnership arrangements would *not* have come about without specific federal attention to this issue through the TRP and, subsequently, the MEP. The Phase I and II case studies demonstrated that state governments did not consistently require public providers of manufacturing assistance to coordinate their efforts. In those states where entirely new centers were developed under the stimulus of the MEP, separate organizations were prompted to form partnerships in direct response to the federal program design. Generally, the organizational and service coordination relationships embodied in these partnerships had not existed before the federal program. The older case study centers in the study – those that were operating before the MEP program – had developed, mostly at their own initiative, a range of informal (and in some instances, formal) alliances and linkages. But, even for these long-established programs, it really took the stimulation of additional federal funding through the MEP for serious attention to be paid to coordination (see also Coburn 1994, National Institute of Standards and Technology 1994).

Although state and local policymakers are probably more disposed towards encouraging service partnerships today than perhaps just a few years ago, we did not find substantial evidence that coordinated service provision would be self-sustaining in the absence of a major federal role. At the state level, maintaining the distinctive "turf" of an individual program is an important and time-honored aspect of budgetary politics. Program managers traditionally perceive greater returns from cultivating their own particular political and business constituencies than from subsuming their activities in a greater whole. (Such program behavior is rational as long as elected officials continue to fund multiple business and economic development programs each with specific functions and line-item budgets located in separate institutions.) In this context, coordinated service provision appears as an "externality" which benefits customers and regional economies more than individual programs. Even those programs that have pursued business-like models and tried to "self-generate" funds through managing external service providers do not, in the end, generate substantial revenues relative to the costs involved. In short, service coordination requires specific attention and resources by sponsors to become established. Some states do, of course, go further than others in encouraging coordination among different business service providers. However, from the view of establishing service coordination and partnership on a nationwide scale, such efforts are most likely to be encouraged and continued by ongoing attention to this element by federal program sponsors.

During the first few years of the MEP program, NIST had a very strong influence on the development of state and local industrial modernization services through its federal funds. The availability of funds – particularly during the TRP "ramp-up" phase – attracted many applicants wishing to "double" their state resources through the federal

match. These applicants readily conformed to program requirements to establish partnerships. Subsequently, during the first three years of MEP center operations, federal funding covered at least one-half of center costs, and enabled resources to be expended on partnership subcontracts, co-locations, shared tools, and other means of promoting cooperation. Purely from a budget perspective, it was in fact very desirable to have partners, as these partners could bring non-MEP "match" into the equation that allowed federal funds to be drawn upon.

The Challenge of Partnership Optimization

However, the context for federal funding is in the process of a significant change. Currently, most MEP centers (and, ultimately, all) are undergoing a planned ramp-down in federal funding. It is anticipated that core federal funding to individual centers will stabilize at about one-third of each MEP centers operating costs.[8] If implemented, NIST would shift from being a "majority" to a "minority" stakeholder in the preponderance of MEP centers. This shift has consequences for ongoing MEP partnership links.

First, the reduction in federal funds has forced MEP centers to rationalize their relationships with service partners. As the case studies illustrated, MEP centers are focusing on developing "tight" service relationships with fewer partners, while maintaining "loose" links with most others. Open-ended funding commitments are generally out, while performance-based relationships are in.

Second, where MEP centers are establishing funded links with other service providers, the tendency is now to do this with special projects. In some cases, NIST has funded these projects, but in most cases these partnered projects are funded by other federal, state or foundation sources. Inevitably, this means a diminution of NIST influence, as MEP centers reorganize their services and partner relationships to meet the requirements of other funding bodies.

Third, as federal funding declines, there is increased pressure on individual MEP centers to focus available resources on fee generation, which often means "selling" short-term projects to firms to raise revenues (see National Institute of Standards and Technology 1998c, Shapira 1998). This can not only increase competition (as opposed to collaboration) with other public and private service providers, but reduces the incentives for long-term investments upgrading industrial service infrastructures and collaboration in par-

[8] The Omnibus Trade and Competitiveness Act of 1988, which initially established the NIST manufacturing technology centers program (subsequently the MEP program), contained a "sunset clause" that limited federal funding to a six years. However, this clause is now widely seen as impractical if the aim is to continue to sustain a nationwide network of industrial extension centers. Indeed, a few older MEP centers have received congressional waivers to allow some continued federal funding. Additionally, in FY 98, as we conducted the Phase II study, Congress was considering legislative action to allow MEP centers to receive federal funds totaling one-third of operating costs after the sixth year, given positive performance reviews. (For more details on these funding issues, see Shapira 1998.)

ticular localities. (As we have noted, coordinated industrial service provision has the characteristics of an "externality" which benefits customers and regional economies more than individual programs.).

Finally, the tightening of federal funds available to MEP centers could make it more difficult for centers to find the resources to develop shared tools, information systems, cross-training, exchanges of best practices, and other specific mechanisms to promote industrial service partnerships.

While the future is always uncertain, these trends within the MEP system generally point to an ongoing rationalization of MEP partnership linkages and coordination arrangements in coming years. To an important extent, this rationalization is desirable and is part of the necessary optimization and performance improvement of the MEP. Not all of the partnership arrangements that were initiated during the initial ramp-up of the program have worked well, there has been a lot of learning about how best to structure partnerships, and needs and framework conditions have changed. At the same time, there is the real danger of partnership sub-optimization – a reversion to a situation where industrial services are poorly integrated, there is confusing duplication in services while gaps are not addressed, individual program missions are emphasized rather than the needs of SMEs and industrial communities, and there is and heightened "turf" conflict between different programs. This situation is clearly not desirable, whether from the perspectives of industry, regional economic development, or good public policy.

In short, policymakers – particularly at the federal level at NIST – face a considerable challenge: how to continue to promote effective partnerships among industrial modernization service providers within an environment of reduced funding. We emphasize the federal level not in the sense of overlooking the importance of local and state responsibility and leadership in promoting coordinated industrial services. Rather, we adopt this view because the evidence in the industrial modernization field (as shown in our case studies) points ultimately to the overriding role of the federal level in creating the frame conditions within which partnership initiatives are encouraged and rewarded. In the next section, we explore how NIST might most usefully target its resources to guide and promote local partnerships given the anticipated changes in funding arrangements.

8. Recommendations for NIST

What can NIST do to foster partnerships and service coordination? We have emphasized the importance of the federal role in promoting partnerships. Although some centers and a handful of states had previously paid attention to this area, only following federal intervention was serious consideration given to coordination. Given the environment of change just described, we offer a series of recommendations that should aid NIST in

promoting the further development and optimization of industrial modernization service coordination.

- **Strategic investment in industrial modernization partnerships**

As the MEP shifts from the phase of establishing new centers to one of optimizing an in-place system, there is a need to attend to strategic and infrastructural investments, particularly those such as service coordination which benefit industrial firms and regional economies more than individual states and centers. In most cases, local manufacturing service partnerships could not exist without the stimulus (and absorption of coordination costs) possible with the relatively small amount of flexible federal funding provided through the MEP.

The current approach to the federal funding of individual MEP centers generally means that federal funds are combined with state funds and fee income to support the operation of each center and its partnership linkages. However, as we have argued above, the decline in federal funds is likely to mean that centers will tend to eschew making further investments in fostering partnerships. We suggest two strategies to help to avoid this. These strategies are not mutually exclusive.

First, NIST should specify more precisely what at least a part of the ongoing federal funding commitment to individual MEP centers is buying. In this case, we would suggest that it should be explicit, in cooperative agreements, that some federal MEP funds are to be used by centers to maintain and build effective partnerships with other local service providers to more effectively assist SMEs. MEP centers would be expected to include strategies, goals, and hard budget lines for partnership activities in their strategic and operating plans. MEP center staff who spend substantial parts of their time in promoting and managing partnerships, as well as other specific partnership projects, could be included within a center's partnership budget.

Second, through available national funds that are not committed to supporting individual centers, NIST could designate a specific program to promote partnerships. This might include seed or matching funds for the development of specific projects (including demonstration projects) to promote partnerships, including partnerships that cross state lines. Also eligible would be partnership projects for the development of shared tools, information systems, and other mechanisms to promote partnerships. Such tools could subsequently be made available for use throughout the MEP system.

Under both strategies, MEP federal financial support could be used to cement relationships with partners in a variety of ways. Of course, ensuring in overall terms that there is sufficient funding for MEP centers to accomplish the public service mission is critical to fostering partnerships. Several partners were concerned that center efforts to generate fee revenue to remain in operation were making it difficult to refer small manufacturers to

the center for assistance. There were also concerns about centers building capacity to offer services in-house that companies are willing to pay for, but that also are provided by other public and private sector providers. In addition, centers seeking fee revenue in some cases dominated partnerships, which led to the creation of ill will and concerns about the viability of ongoing relationships with the center. Although the pursuit of projects that companies are willing to pay for does impose operational discipline on centers, the existence of stable funding itself is necessary to support public benefits such as service coordination (National Institute of Standards and Technology 1998c).

- **Robust panel review**

The MEP has fostered partnerships with public and private service providers, which has improved the coordination and flexibility of manufacturing extension services, integrated a wider range of service expertise, reduced inefficient overlaps, and helped new centers expand quickly by leveraging existing resources. Yet partnerships can be expensive to maintain, in terms of administrative coordination and political capital. Some local MEP partnerships were put together hastily, for the purposes of grant application, leading to instability in the partnership; in other instances, technically competent but politically weak service providers have been subordinated. As the MEP shifts from rapid growth to maturity, it must address these deficiencies. Indeed, our case studies indicate that centers are acting to rationalize their partnership arrangements.

MEP's review process should continue to encourage attention to partnership arrangements. In the future, major external reviews are anticipated every two years as a condition of continued federal funding, with internal NIST staff reviews possible on an annual basis. This timetable may be too short to adequately assess longer-term partnership development investments, but it could be workable if centers are prompted to develop four year strategic plans, with a major review at the two-year mark..

In any event, the external review process should reinforce center initiatives to optimize relationships with capable partners and to address links with poorly organized or sub-par local affiliates. It should be clearly stated in cooperative agreements and in review procedures that the strength and effectiveness of a center's formal and informal relationships with other industrial service providers is an important criterion for continued federal funding. Upholding this criterion in the biannual review process can be improved by ensuring the inclusion of independent external reviewers who will be less influenced by potential political problems when recommending hard decisions about discontinuing funding or recommending organizational changes that affect local centers. In instances where partner relations are an issue, input from key partner organizations should be incorporated into the review process. Panels should take a long-term view of individual center partner relationships, probing whether investments are being made in new linkages to meet emerging needs and opportunities, as well as monitoring ongoing relationships with existing partners.

- **Fostering a national framework for service linkages**

The problem of duplication of services and poor coordination exists at the federal as well as the state level, with many duplicative and uncoordinated federal programs aimed at "assisting" industry and small companies (Shapira 1998). Given the structure of federal governance, complete coordination is not possible. But significant improvements can be made. Here, NIST has an important (and unique) role at the national level in promoting a more coordinated national framework for local MEP service linkages.

NIST and its parent agency, the U.S. Department of Commerce, can help to broker agreements at the national level with other agencies to coordinate and deliver MEP services. NIST already has coordination agreements with the Labor and Agriculture Departments, a pilot collaboration with elements of the Small Business Development Centers program, and a collaboration with the Environmental Protection Agency to use the MEP network to provide environmental services to small and mid-sized firms. NIST should pursue further opportunities to eliminate barriers to collaborative linkages between different federal programs and to signal that positive working relationships can and should be forged. Although the MEP system should not be expected to deliver all federally-sponsored services to SMEs, there is further scope for the MEP to serve as an effective distribution network for selected other federal services targeted to small firms, including federal laboratory SME outreach efforts. NIST agreements with other membership organizations and industrial or trade associations can also open pathways for collaboration between individual MEP centers and local chapters.

Equally important, the MEP's flexible structure can be used to actively promote working relationships at the state and local levels among different programs. For example, centers have found it useful for MEP managers to travel to center-partner meetings in support of partnership efforts. The MEP manager can explain the program's mission, service approach, and operation, as well as address any misconceptions that the state or local partner may have about the program.

- **Linkages with SBDCs**

The need and opportunity to better coordinate manufacturing extension services with small business development centers (SBDCs) is being recognized at state and local levels by MEP affiliates. There are important mutual benefits for MEP and SBDC service providers and business customers when services are coordinated, effective referral systems are in place, information is shared, and joint planning occurs. At the same time, it should be admitted that there are differences between MEP and SBDC centers in terms of mission, history, expertise (particularly related to manufacturers), service approaches, and reward systems. Although special funding through the MEP system to SBDC's provides context and resources to strengthen linkages, the experience of the cases we examined

indicates that such funding by itself is not sufficient to ensure viable service linkages that benefit firms.[9]

To be most effective, MEP and SBDC coordination has to occur at the local program level, with strong relationships and mutual trust built between staff and their respective centers. Co-location is one way of facilitating these relationships, although other forms of coordination are possible and necessary too. In each locality, MEP and SBDC coordination takes different forms, depending on local conditions and institutional arrangements and capabilities.

Federal policy should encourage local MEP's and SBDC's to better coordinate, but federal policymakers should avoid developing standardized models (which do not take into account local differences). Moreover, SBDCs should not be exempt from requirements applied to all service providers that they offer services that are effective, responsive and of high quality as a precondition for continued MEP affiliation. As our case research indicated, MEP's centers facing new budget situations or changes in customer requirements need to have the flexibility to adjust their partner arrangements and to benefit from learning about partner capabilities in relationship to customer needs so as to optimize MEP service delivery.

Our case study findings do not endorse the special "earmarking" of MEP funds to be allocated to SBDC linkages. While we do endorse a more general policy of assigning federal funds to the promotion of partnership linkages, MEP centers should be able to determine the composition of such linkages based on local needs, capabilities, strategic goals, and experience – with the effectiveness of particular MEP centers in building strong service partnerships being a major factor in reviews for continued federal funding.

- **Evaluation**

Evaluations of programs involving partnerships have to face the "normal" problems facing all program evaluations of economic and technological policies. These include the difficulty of quantifying full costs and benefits, selection bias, and accounting for counter-factual explanations of claimed program impacts. But, in addition, partnerships pose extra challenges and hazards for evaluation as a function of the greater organizational complexity inevitably associated with partnerships (Shapira, Kingsley, and Youtie 1997). Multiple organizations across different levels and sectors can bring diverse evaluation approaches and metrics. There are also issues regarding collecting reporting data in a way that avoids multiple client contacts by different organizations, determining which organi-

[9] A similar conclusion was reached by Yin et al. (1998) in their evaluation of MEP-SBDC partnerships. They found that additional fund allocated to these partnerships did not necessarily result in improved service to priority clients or more integrated services. This study emphasized the need for strong safeguards to ensure the effective use of funds.

zation "owns" which client, and deciding how to report this to program sponsors without double-counting.

Additionally, we note a dichotomy between the expressed strategy of the MEP in promoting service partnerships and the trends in MEP monitoring and evaluation. In particular, the emphasis on "what counts" in NIST's evaluation systems is individual project performance. This is not to say that other information items are not collected, but that that the weight of attention is focused on the individual project. Centers feel pressure (often implicit, rather than formal) to raise individual project counts and generate immediate project income. Attention is thus focused away from long-term efforts to promoted coordinated services within industrial communities, the benefits of which cannot be easily captured by data at the individual project level.

The challenge is thus presented of how to make evaluation systems better capture and reflect the range of activities that MEP centers do and should undertake. This is not an easy task, in part because some activities (including certain aspects of service coordination) have intangible benefits that cannot be quantified. Nonetheless, NIST should take the initiative in ensuring that the emphasis on individual project evaluation is at least matched by comparable efforts to benchmark and assesses MEP center performance at the level of the industrial community. There are three steps that NIST might take.

First, NIST should review and upgrade procedures for collecting information about MEP partner relationships. The current procedures allow considerable discretion and leeway about what MEP centers report, making valid comparisons difficult. There is a need to more clearly define what centers should report to NIST about their partnerships, including information about the intensity and characteristics of linkages, and how these relationships are used. Moreover, we encourage NIST to regularly analyze and report this data, so that individual centers can compare the development of their relationships and the system as a whole can more accurately track trends in partnership linkages.

Second, and related to the previous point, NIST could include a greater emphasis on benchmarking and measuring the use, contribution, and costs of partnerships in ongoing and new efforts to benchmark panels of centers.

Third, NIST can play an important role in involving other MEP partnership stakeholders in discursive yet structured discussions about how to better evaluate the system-level impacts of MEP partnerships that involve multiple service providers. The theme here would be to go beyond project impact measurement to developing broader assessments of the contribution (or otherwise) of MEP partnerships in regional industrial communities. Such evaluations would not necessarily be required to come up with bottom-line dollar figures, although these evaluations would have to use methodologies that can facilitate judgements about effectiveness. A useful basis for dialogue might be found through drawing on the experience of institutional approaches to evaluation in the broader tech-

nology policy field, including "meta-evaluation" (which attempts to assess the roles and contribution of program initiatives in the context of multiple-actor systems – see Kuhlmann 1998) or the application of network analysis and value mapping (Kingsley et al. 1996, Youtie, Bozeman, and Shapira 1998).

- **Best Practice Dissemination**

There is much tacit knowledge about the effective operation and management of service partnerships that individual programs typically learn the hard way – through their own experience, by making mistakes as well as producing successes. Statements of current practice try to make this tacit knowledge more explicit, but brief written statements cannot easily communicate all aspects, even if backed up by weighty reports. For this reason, we recommend that it would be valuable for NIST, as an essential MEP system-wide function, to promote the exchange of information and experience on managing service partnerships. The methods to achieve this would include forums, training events, and the exchange of personnel. Center staff who devote much of their time to maintaining partnerships with third party organizations could benefit from training in this area about how to initiate, develop, and maintain partnerships. Such exchanges would be complemented by the ongoing benchmarking and assessment of MEP partnerships and by the development and dissemination of case examples where firms have been assisted through coordinated services (for several examples of successful engagements involving coordinated services, see Cosmos, 1996). Technical information, such as sample contract clauses or models of exemplary strategic partnership plans, might also be more widely disseminated, perhaps through NIST's MEP worldwide web site. We also recommended continued attention to issues of service coordination in written materials, guidance to program managers, NIST external program reviews and evaluations, and re-funding decisions.

9. Conclusions

Our study of organizational and service delivery arrangements in MEP centers and their affiliates highlighted the critical role played by the federal government in stimulating a greater degree of service coordination and inter-organizational partnership at the state and local level. The MEP case studies found real benefits associated with service coordination. These included avoiding the duplication of services, tapping specialized skills, spreading development costs of new tools, broader marketing to new industrial customers, improving access to particular industries and areas, flexibility in staffing and the delivery of services, improving service quality, enhancing visibility in the locality, and strengthening state and local support.

At the same time, while service coordination had significant advantages, we also drew attention to the fact that there are costs and potential tensions from this. These drawbacks included increased transaction costs (including the expense of identifying service providers, information sharing, contract management, and monitoring projects), difficulties in maintaining quality across partner organizations, delays in timely service delivery, and inter-organizational tensions through unresolved conflicts over client and service territories. The dispersion of technical expertise and learning from the central organization to affiliated partners may also an issue.

With increased attention being paid to promoting the coordination of services in industrial modernization and also other areas of technology transfer, there should be a careful assessment of the benefits and costs of coordination. In the MEP examples, we found that new partnership arrangements resulted in significant advantages, but this should not lead policymakers and program managers to overlook the reality that there are expenses and tensions associated with greater service coordination. Investments of resources, time, people, technology, and political capital are needed to make service partnerships work well.

We saw that partnerships changed over the past three years as organizational learning and changing budget situations and customer requirements occurred. Centers decentralized many service coordination functions, focusing them at the regional office or project management level. This allowed relationships and arrangements too vary depending on local conditions and institutional structure and capabilities. Several MEP centers found they had to streamline their internal operations to effectively manage partner relations. Reductions in NIST funding led centers to pay more attention to the costs and benefits of working with different partners. Centers are applying requirements to their service providers that they offer services that are effective, responsive and of high quality as a precondition for continued MEP affiliation. As our case research indicated, MEP centers need to have the flexibility to adjust their partner arrangements and to benefit from learning about partner capabilities in relationship to customer needs so as to optimize MEP service delivery. Thus NIST should encourage centers to better coordinate, but should avoid developing standardized models (which do not take into account local differences).

This report identified a series of service coordination practices to help MEP centers, and probably other organizations involved in collaboratively delivered programs, gauge their performance in coordinating services. Applied appropriately, these practices may also assist programs to increase the effectiveness of their service coordination, reducing associated drawbacks and optimizing the quantity, quality, flexibility and comprehensiveness of services delivered for total resources expended across multiple organizations in a locality. Moreover, such practices - when combined together in ways appropriate to local conditions and coupled with a complementary funding, professional staffing, and policy environment - are likely to result in what is most important to industrial customers: en-

suring that industrial modernization services and other technology and business assistance services delivered through multi-organizational arrangements are effective, consistent, and strategic.

The report also highlighted the importance of a federal role in promoting service coordination. Several recommendations were offered to guide NIST's future role in enhancing partner relations. These included making strategic investments in service coordination, providing incentives for centers to assess partner performance through the panel review process, establishing linkages with other organizations at the national, state and local levels, and fostering a dialogue about evaluation. With NIST's continued involvement, we believe that U.S. manufacturing technology partnerships will sustain the investment in the social infrastructure for technology development and diffusion.

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